

WHAT IS CLAIMED IS:

1. An optical information recording medium, at least storing information that indicates a standard recording linear velocity  $V_r$  and/or a maximum recording linear velocity  $V_h$ , said optical information recording medium comprising:
- 5 a transparent substrate having a concentric circular guide groove or a spiral guide groove, said guide groove having land portions and grooves portions; and
- at least a phase change type recording layer on said transparent substrate,
- 10 when reflectivity of said optical information recording medium is measured, while irradiating energy on said guide groove such that the energy melts the material of said phase change type recording layer and while rotating
- 15 said optical information recording medium and increasing a linear velocity of gradually, and when the linear velocity at which the reflectivity of said optical information recording medium decreases, in comparison to the state when the energy is not radiated, is defined as dislocation linear
- 20 velocity  $V$ , then the dislocation linear velocity  $V$  satisfies a relation

$$V \geq V_r \times 0.85 \text{ or}$$

$$V \geq V_h \times 0.85.$$

2. The optical information recording medium according to claim 1, wherein the dislocation linear velocity V satisfies a relation

$$V_r \times 0.9 \leq V \leq V_r \times 2.0 \text{ or}$$

5  $V_h \times 0.9 \leq V \leq V_h \times 2.0.$

3. The optical information recording medium according to claim 1, wherein said optical information recording medium further stores information that indicates that said optical  
10 information recording medium satisfies the relation relating to the dislocation linear velocity V.

4. The optical information recording medium according to claim 1, wherein at the time of crystallizing an entire  
15 surface of said phase change type recording layer, an initialization linear velocity  $V_i$  satisfies a relation

$$V_r \times 0.5 \leq V_i \leq V_r \times 1.6 \text{ or}$$

$$V_h \times 0.5 \leq V_i \leq V_h \times 1.6$$

20 5. The optical information recording medium according to claim 1, wherein a track pitch of said guide groove is between 0.2 and 1.4  $\mu\text{m}$ , and the dislocation linear velocity V is between 6 and 24 m/s.

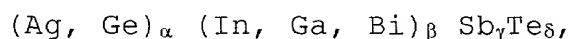
6. The optical information recording medium according to claim 1, wherein when no data is recorded, the phase change type recording layer has a cubic lattice crystal structure.

5 7. The optical information recording medium according to claim 1, wherein said phase change type recording layer is made from a material that includes a material that satisfies the relation

10  $Sb_{\chi}Te_{100-\chi}$  (where  $\chi$  is atomic percentage and  $40 \leq \chi \leq 80$ ).

8. The optical information recording medium according to claim 7, wherein said phase change type recording layer has at least one element selected from a group consisting  
15 of Ga, Ge, Ag, In, Bi, C, N, O, Si, and S, as an additive element.

9. The optical information recording medium according to claim 1, wherein said phase change type recording layer  
20 is made of material that satisfies a relation



where (Ag, Ge) means at least one element selected from Ag and Ge, (In, Ga, Bi) means at least one element selected from In, Ga, and Bi,  $\alpha$ ,  $\beta$ ,  $\gamma$ , and  $\delta$  represent atomic percentages  
25 and satisfy the relation

$$0.1 \leq \alpha \leq 7,$$

$$1 \leq \beta \leq 15,$$

$$61 \leq \gamma \leq 85, \text{ and}$$

$$20 \leq \delta \leq 30.$$

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10. The optical information recording medium according to claim 1, wherein under recording conditions such that

when  $n$  represents an integer equal to or higher than 1, and  $T$  represents a clock time corresponding to a period of a clock used for modulating a signal, a recording beam at the time of recording or rewriting a 0 signal having a signal width  $n \times T$  after modulation is a continuous beam having a power level  $e$ ,

a pulse string of a recording beam at the time of recording or rewriting a 1 signal having a signal width  $n \times T$  after modulation is a laser wave pulse string that has a pulse portion  $fp$  having a time width  $x$  and a power level  $a$ , a multi-pulse portion  $mp$  in which a low-level pulse of a power level  $b$  having a time width  $T$  in total and a high-level pulse having a power level  $c$  alternately appear and continue by  $(n - n')$  times in total at a duty ratio  $y$ , and a pulse portion  $ep$  having a time width  $z$  and a power level  $d$ , and

the time width  $x$ , duty ratio  $y$ , and the time width  $z$  satisfy relations  $T \times 0.125 \leq x \leq T \times 2.0$ ,  $0.125 \leq y \leq 0.875$ , and  $T \times 0.125 \leq z \leq T$ , and the power levels  $a$ ,  $b$ ,  $c$ ,

d, and e satisfy a relation  $a \& c > e > b \& d$ , then

a first protection layer, said phase change type recording layer, a second protection layer, a reflection layer, and a resin layer are formed on said transparent substrate in such a manner that the thickness of each layer makes it possible to record at a higher speed than the standard recording linear velocity  $V_r$  or the maximum recording linear velocity  $V_h$ .

10 11. The optical information recording medium according to claim 1, wherein said optical information recording medium has a multilayer structure with at least a first protection layer, said phase change type recording layer, a second protection layer, a third protection layer, a reflection layer, and a resin layer stacked in order on said transparent substrate.

12. The optical information recording medium according to claim 11, wherein a material constituting said third protection layer is formed by DC sputtering.

13. The optical information recording medium according to claim 11, wherein a material constituting said third protection layer includes at least one substance selected from a group consisting of C, Si, SiC, SiN, SiO, and SiO<sub>2</sub>.

14. The optical information recording medium according to claim 1, wherein a linear velocity when crystallizing an entire surface of said phase change type recording layer is slower than the dislocation linear velocity V.

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15. A method of recording/reproducing optical information, the method comprising the steps of:

setting a phase change type of optical information recording medium to an optical information recording/reproducing apparatus, said optical information recording medium recording in advance specific information indicating that a dislocation linear velocity corresponding to said optical information recording medium satisfies a specific relation;

15 reproducing the specific information from said optical information recording medium;

deciding from the specific information, whether it is possible or not to record at a recording linear velocity higher than a maximum recording linear velocity of the optical information recording medium; and

20 recording and reproducing at a recording linear velocity higher than the maximum recording linear velocity, when it is decided in the deciding step that it is possible to record at a higher recording linear velocity than the maximum recording linear velocity.

16. An apparatus for recording/reproducing optical information, the apparatus comprising:

a specific information reproduction unit which reproduces a specific information from a phase change type of optical information recording medium, wherein said optical information recording medium recording in advance the specific information indicating that a dislocation linear velocity corresponding to said optical information recording medium satisfies a specific relation;

a deciding unit which decides from the specific information, whether it is possible or not to record at a recording linear velocity higher than a maximum recording linear velocity of the optical information recording medium; and

a data reproduction/recording unit which reproduces or records at a linear velocity higher than the maximum recording linear velocity, when said deciding unit decides that it is possible to record at a higher recording linear velocity than the maximum recording linear velocity.

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17. A phase change type optical information recording medium comprising a recording layer made from a phase change recording material that changes between an amorphous state and a crystalline state based on irradiation of an electromagnetic beam, wherein

the phase change recording material includes at least one element selected from Ag, In, Sb, and Te, and a bond coordination number of the selected element/s is different between an amorphous state after a film formation and a crystalline state after an initialization and after an information erasing.

18. The optical information recording medium according to claim 17, wherein among the constituent elements of the phase change recording material, a bond coordination number of Ag and In with respect to Te in the crystalline state is larger than a bond coordination number of Ag and In with respect to Te in the amorphous state.

19. The optical information recording medium according to claim 17, wherein among the constituent elements of the phase change recording material, a bond coordination number of Ag with respect to Te in the amorphous state is between 1.5 and 2.5, and a bond coordination number of Ag with respect to Te in the crystalline state is between 3.5 and 4.5.

20. The optical information recording medium according to claim 17, wherein among the constituent elements of the phase change recording material, a bond coordination number of In with respect to Te in the amorphous state is between

3.0 and 3.8, and a bond coordination number of In with respect to Te in the crystalline state is between 3.4 and 4.2.

21. The optical information recording medium according to claim 17, wherein among the constituent elements of the phase change recording material, a bond coordination number of Sb with respect to Te in the crystalline state is smaller than a bond coordination number of Sb with respect to Te in the amorphous state.

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22. The optical information recording medium according to claim 21, wherein among the constituent elements of the phase change recording material, a bond coordination number of Sb with respect to Te in the amorphous state is between 2.7 and 3.5, and a bond coordination number of Sb with respect to Te in the crystalline state is between 2.0 and 2.8.

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23. The optical information recording medium according to claim 17, wherein the phase change recording material has an NaCl type structure in the crystalline state.

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24. The optical information recording medium according to claim 23, wherein among the constituent elements of the phase change recording material, Cl site in the NaCl type structure occupied by Te has a large number of holes.

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25. The optical information recording medium according to claim 24, wherein among the constituent elements of the phase change recording material, Cl site the NaCl type structure to be occupied by Te has holes between 7/12 and 5 9/12.

26. A method of manufacturing a phase change type optical information recording medium, said optical information recording medium comprising a recording layer made from a 10 phase change recording material that changes between an amorphous state and a crystalline state based on irradiation of an electromagnetic beam, wherein

the phase change recording material includes at least one element selected from a group consisting of Ag, In, Sb, 15 and Te, and a bond coordination number of the selected element/s is different between an amorphous state after a film formation and a crystalline state after an initialization and after an information erasing, and

wherein said recording layer is formed with an electric 20 power between 250 W and 850 W while raising a temperature of a substrate at a constant rate between 10 °C/min and 50 °C/min.

27. An optical information recording medium comprising:  
25 a disk-shaped substrate; and

at least a phase change type recording layer stacked  
on said substrate, wherein said phase change type recording  
layer is made from material which includes Ge, Ga, Sb, and  
Te, and when  $\alpha$ ,  $\beta$ ,  $\gamma$ , and  $\delta$  represent atomic percentages of  
5 Ge, Ga, Sb, and Te, and  $\alpha + \beta + \gamma + \delta = 100$ , then  $\alpha$ ,  $\beta$ ,  $\gamma$ ,  
and  $\delta$  satisfy the relations

$$0.1 \leq \alpha \leq 7,$$

$$1 \leq \beta \leq 9,$$

$$61 \leq \gamma \leq 75,$$

10  $22 \leq \delta \leq 30.$

28. The optical information recording medium according  
to claim 27, wherein said phase change type recording layer  
has been added with at least one element selected from a  
15 group consisting of In, Zn, Sn, Si, Pb, Co, Cr, Cu, Ag, Au,  
Pd, Pt, S, Se, Ta, Nb, V, Bi, Zr, Ti, Al, Mn, Mo, Rh, C,  
N, and O.

29. The optical information recording medium according  
20 to claim 27, wherein a composition ratio of Ge and Ga is  
 $-8 \leq \alpha - \beta \leq 3.$

30. The optical information recording medium according  
to claim 27, wherein a composition ratio of Sb and Te is  
25  $\gamma + \delta \geq 88.$

31. The optical information recording medium according to claim 27, wherein

the optical information recording medium is applied with an information recording/reproducing method for recording, reproducing and rewriting information onto/from the optical information recording medium, by generating a phase change in a recording layer of the optical information recording medium based on irradiation of a laser beam onto the optical information recording medium, and

it is made possible to execute a multi-speed recording and/or a CAV recording onto the optical information recording medium, based on an arrangement that

in the case of recording information onto an information recording medium by modulating a signal according to a PWM recording system, a recording wave at the time of recording or rewriting a 0 signal having a signal width  $n \times T$ , where  $T$  is a clock time, after modulation is a continuous beam having a power level  $e$ , and

a recording wave pulse string at the time of recording or rewriting a 1 signal having a signal width  $nT$  after modulation is an electromagnetic wave pulse string that has a pulse portion  $f_p$  having a time width  $x$  and a power level  $a$ , a multi-pulse portion  $m_p$  in which a low-level pulse of a power level  $b$  having a time width  $T$  in total and a high-level pulse having a power level  $c$  alternately continue by  $(n -$

n') times in total at a duty ratio y, and a pulse portion  
op having a time width z and a power level d, where the time  
width x, duty ratio y, and the time width z satisfy relations  
 $T \times 0.5 \leq x \leq T \times 2.0$ ,  $0.125 \leq y \leq 0.875$ , and  $T \times 0.125 \leq$   
5  $z \leq T$ , where n' is a positive integer equal to or greater  
than n, and the power levels a, b, c, d, and e satisfy a relation  
 $a \& c \geq e \geq b \& d$ .

32. The optical information recording medium according  
10 to claim 31, wherein a duty ratio of the pulse portion mp  
increases or decreases according to a recording linear  
velocity.